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The Generalized Stability Indicator of Fragment of the Network. III Calculating Method and Experiments

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Abstract

In this paper developed a method calculating the generalized stability indicator. Taken into account the classification of critical performance event on the basis of mutual influence within the corporate network. Shows plots of the major dependencies. Complies with the requirements of the model is checked.

Keywords: generalized stability, directive impact, corporate network, critical performance event

1 Introduction

The set of all nodes (Fig. 1) in a common network somehow affecting the stability of the nodes, divided into four groups: direct vendors of P_0, component group H subnet with priority higher than the priority of the node P_0, node group N subnet with a lower priority and a group of nodes with equal priority. The work is based on research [1-6].

2 Algorithm of calculating the generalized stability of node in the subnet of homogeneous nodes

Generalized stability indicator of the node P_0 operating in homogeneous enterprise network *H* is defined as the probability that the node will not become in critical situation$p_0 = 1 - \bar{p}_0$ (see, for example [7]). Where $\bar{p}_0$ is coefficient of instability - the chance that the node will be left without the necessary amount of resources. Condition of criticality elementary event$(\varepsilon_1, \varepsilon_2, \ldots, \varepsilon_{i_m}, \delta_0, \delta_1, \ldots, \delta_{j_3})$, where

$$\varepsilon_i = \begin{cases} 0, \text{if homogenous node } P_{1j} \text{ has an accident,} \\ 1, \text{if homogenous node } P_{1j} \text{ has no accident,} \end{cases}$$

$$\delta_j = \begin{cases} 0, \text{if there are any directive redistribution} \\ 1, \text{if there are no directive redistribution} \end{cases}$$

was defined in previous part of present paper "The generalized stability indicator of fragment of the network. II. Critical performance event." Probability p_N of the elementary event is $p_N = \left(\prod_{l=1}^{i_m}\left(p_{1l}^{\varepsilon_l}\nu_{1l}^{\varepsilon_l}\right)\right) \cdot \left(\prod_{k=0}^{j_3} q_k^{\delta_k}\right)$. Here$\nu_{1l}$– strength of links between nodes P_0 and P_{1l},

$$p_{1l}^{\varepsilon_l} = \begin{cases} p_{1l}, \text{ if } \varepsilon_{1l} = 1 \\ 1 - p_{1l}, \text{if } \varepsilon_{1l} = 0 \end{cases}, \quad q_k^{\delta_k} = \begin{cases} 1 - q_k, \text{if } \delta_k = 1 \\ q_k, \text{if } \delta_k = 0 \end{cases},$$

where q_k– the probability of occurrence of force majeure on the node.

Coefficient of instability $\bar{p}_0$ is the sum of the probabilities of independent critical performance elementary event (next CPE). Hence the generalized stability indicator of node P_0 in subnet *H* is

$$p_0 = 1 - \bar{p}_0 = 1 - \sum_{\text{critical N}} \left(\prod_{l=1}^{i_m}\left(p_{1l}^{\varepsilon_l}\nu_{1l}^{\varepsilon_l}\right)\right) \cdot \left(\prod_{k=0}^{j_3} q_k^{\delta_k}\right)$$

The results of some numerical experiments on the computation of the individual factors of stability of nodes in the network structure of homogeneous companies, as well as generalized stability coefficients of entire subnets are listed in the following section.

3 Experiments

During playback, the production scenario will consider the network fragment corporation with three homogeneous groups of nodes enterprises (Fig. 1).

We investigate how much the stability coefficient of some node in the network depends on, the ability to influence decision-making (under the legislative action will be understood, first of all, the reallocation of resources), the stability of neighboring businesses. Probability of such effects use a value of 0.2.

Next in the course of experiments, we investigated confer node P_0 consistently low, medium and high priorities as it shown in Fig 1.

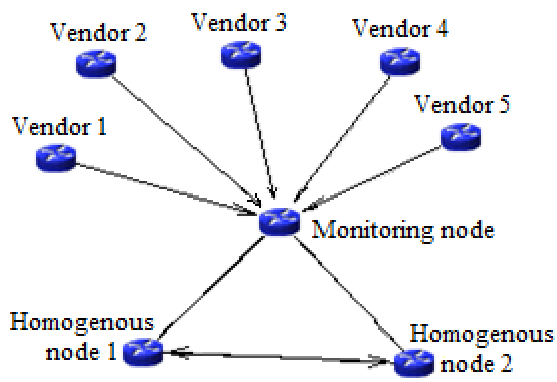

Fig. 1. A fragment of the network with three homogeneous groups of nodes-enterprises

Fig. 2-4 shows the stability coefficients nodes-enterprises in the corporate network depends on the amount of the reserve in terms of the stability of neighboring nodes-enterprise 0.8, 0.9, 0.95.

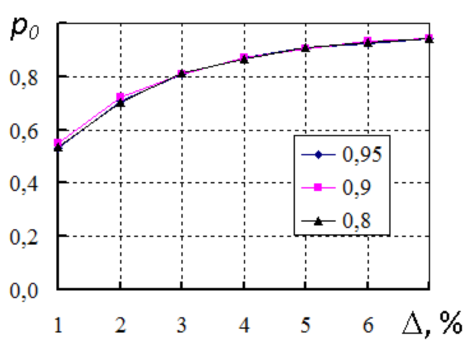

Fig. 2. Low priority node

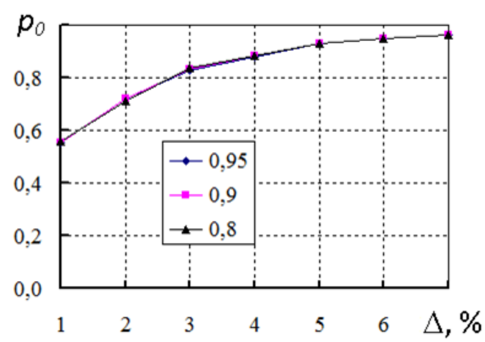

Fig. 3. Medium priority node

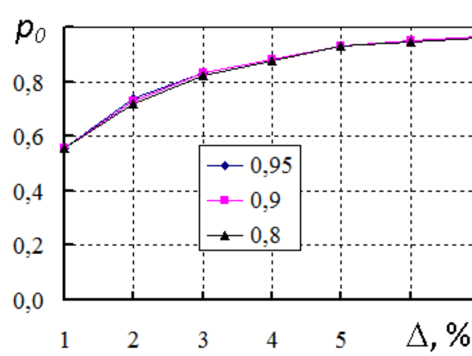

Fig. 4. High priority node

Fig. 2-4 shows that the variation of the stability of the node, even with a low priority on a corporate network, as a result of the impact of policy-making practically does not depend on the stability of neighboring nodes businesses. This is due to the fact that the directive reallocation of resources is not so much on the results of the work of this node, but because of the reallocation of resources due to force majeure or changes in the strategic plans of the preliminary screening center.

We now investigate the dependence of the stability of the node in the network of homogeneous nodes on the level of policy influence. Fig. 5-7 shows the stability coefficients nodes-enterprises depending to the impact of policy on the frequency when the amount of reserves 2, 4 and 6%.

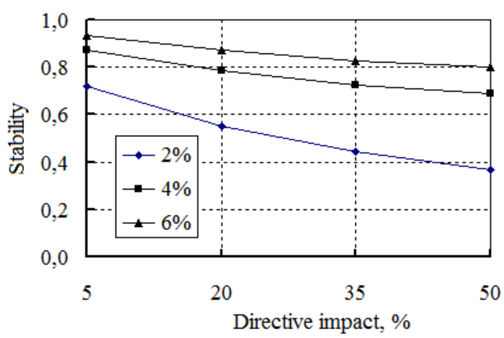

Fig. 5. Low priority node

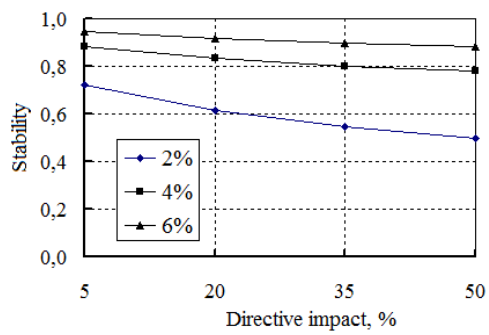

Fig. 6. Medium priority node

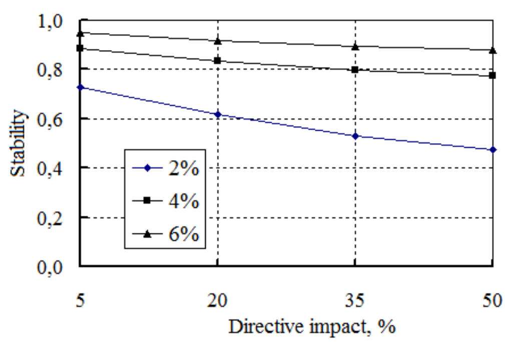

Fig. 7. High priority node

It is easy to see (Fig. 5-7), that as the policy impact growth, regardless of the priority, decreases the stability of nodes-enterprises. However, the increase in reserves "on the ground", i.e., for each individual node P_0, can significantly reduce the negative effect.

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